

FCC PART 15.247

TEST REPORT

For

Lierda Science & Technology Group Co., Ltd0

Lierda Building, 425 Dengyun Rqcd, Hangzhou, China

FCC ID: N8NLSD4MEO

Report Type: Original Report	Product Type: Lierda BLE Anti-lost Device
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Report Number:	R2SH131029055-00
Report Date:	2013-11-18
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Lierda Science & Technology Group Co., Ltd* 's product, model number: *LSD4BT-E74PMEO0* (FCC number: *N8NLSD4MEO*)(the "EUT") in this report is an *Lierda BLE Anti-lost Device*, Which was measured approximately: 4.5cm (L) x 3.5 cm (W) x 0.8 cm (T), rated input voltage: DC 3.0 V from button battery.

** All measurement and test data in this report was gathered from production sample serial number: 131029055 (Assigned by BACL.Dongguan). The EUT was received on 2013-10-30.*

Objective

This report is prepared on behalf of *Lierda Science & Technology Group Co., Ltd* in accordance with Part 2-Subpart J, Part 15-Subparts A, B and C of the Federal Communications Commission's rules.

The tests were performed in order to determine the compliance of the EUT with FCC Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

No related submittal(s)/grant(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 02, 2012. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratories Corp. (Dongguan) is an ISO/IEC 17025 accredited laboratory, and is accredited by National Voluntary Laboratory Accredited Program (Lab Code 500069-0).



The current scope of accreditations can be found at <http://ts.nist.gov/standards/scopes/5000690.htm>

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a test mode. The system was configured the maximum power as default value.

For Bluetooth LE mode, 40 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404
...
...
..	...	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

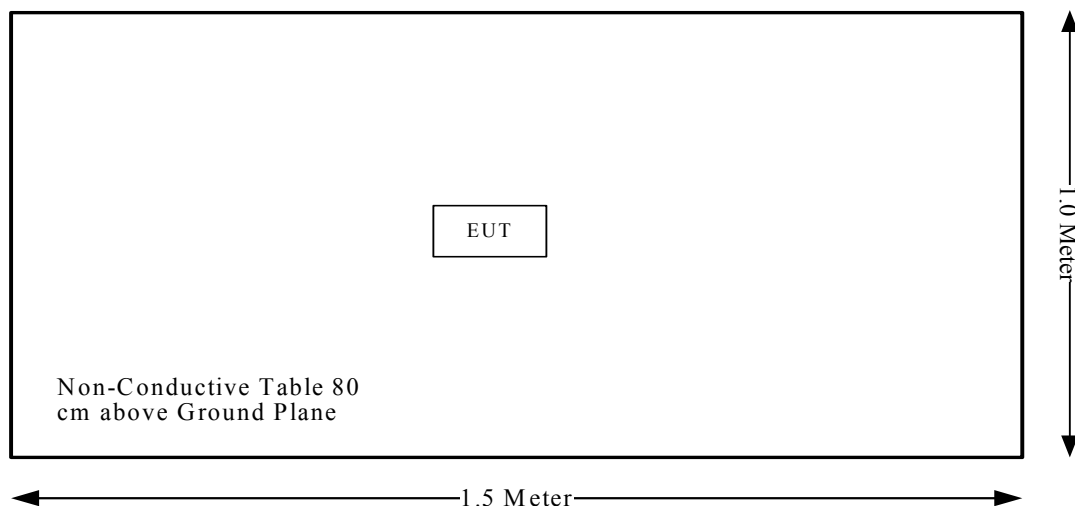
EUT Exercise Software

No software was used in the test.

Equipment Modifications

No modification was made to the EUT tested.

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1093	RF EXPOSURE	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Not applicable*
§15.247(d)	Spurious Emissions at Antenna Port	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

Not applicable*: the EUT was powered by battery.

FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

According to §15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 Mobile Portable RF Exposure V05 Appendix A, SAR can be exempted if the output power is less than the SAR exclusion threshold:

For $f=2450\text{MHz}$, the output power is less 10mW at distance of 5mm.

Measurement Result

Peak conducted output power= 0.99 dBm

SAR exclusion threshold 10 mW (10'dBm) > 0.99 dBm

So the SAR evaluation is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
 - b. Antenna must use a unique type of connector to attach to the EUT.
- Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Connector Construction

The EUT has a printed antenna, which was permanently attached to the EUT, and the maximum gain is 1.0'dBi, please refer to the internal photos.

Result: Compliance.

FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 2, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:

30M~200MHz: 5.0 dB

200M~1GHz: 6.2 dB

1G~6GHz: 4.45 dB

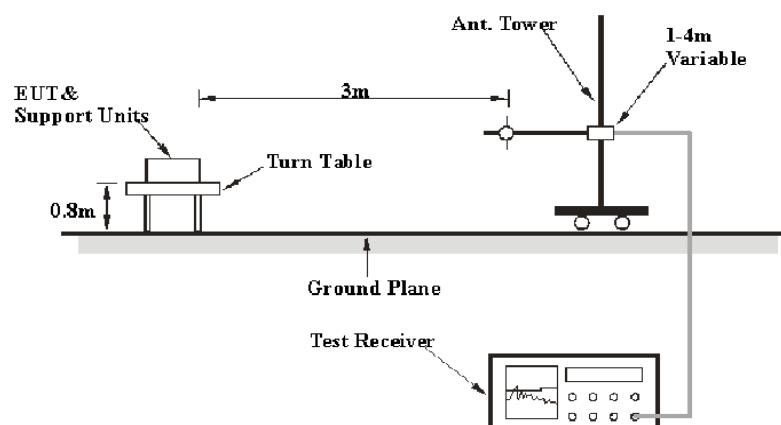
6G~18GHz: 5.23 dB

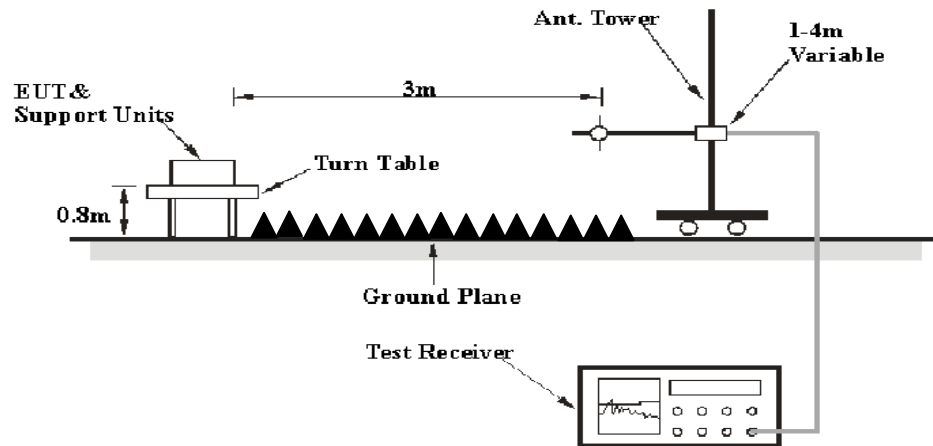
Table 2 – Values of U_{cispr}

Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1GHz:



Above 1GHz:

The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30MHz – 1000 MHz	120 kHz	300 kHz	120kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI TEST RECEIVER	ESCI	100224	2013-5-6	2014-5-5
Sunol Sciences	Antenna	JB3	A060611-1	2011-9-6	2014-9-5
HP	HP AMPLIFIER	8447E	2434A02181	N/A	N/A
R&S	Spectrum analyzer	FSEM 30	849016/001	2012-12-7	2013-12-6
ETS LINDGREN	horn antenna	3115	000 527 35	2012-9-6	2015-9-5
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	N/A	N/A
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15
Ducommun Technologies	Horn antenna	ARH-4223-02	1007726-02-1304	2013-6-16	2014-6-15
QUINSTAR	Amplifier	QLW-18045536-J0	15964001001	N/A	N/A

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Section 15.205, 15.209 and 15.247, with the worst margin reading of:

10.06 dB at 2483.5 MHz in the Horizontal polarization

Test Data

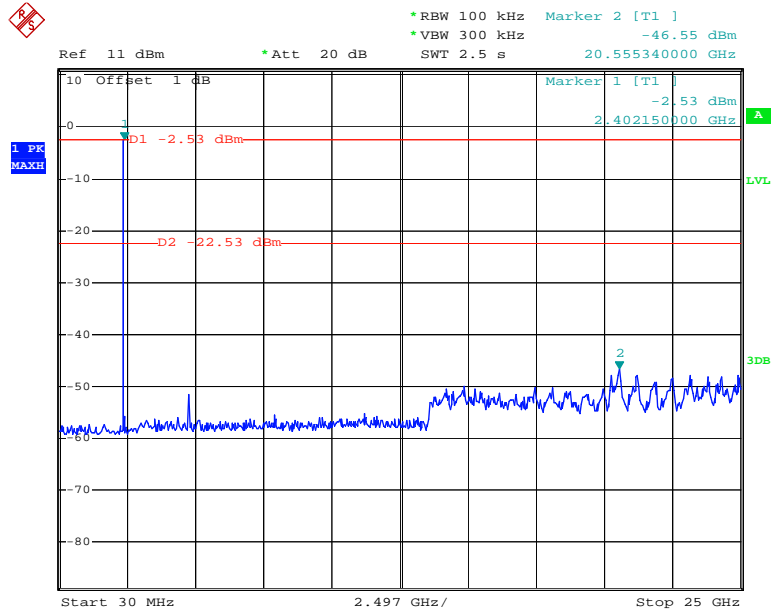
Environmental Conditions

Temperature:	24.3 °C
Relative Humidity:	54 %
ATM Pressure:	101.5 kPa

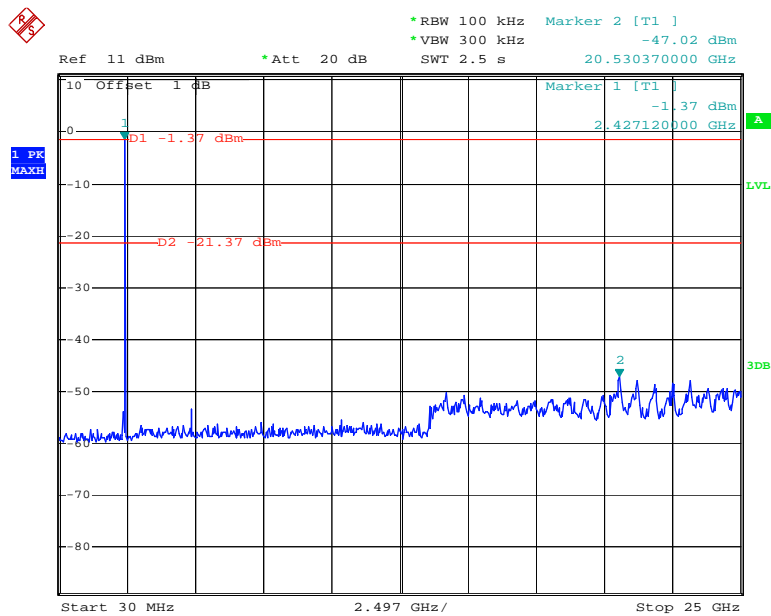
The testing was performed by Ares Liu on 2013-11-15.

Mode: Transmitting

Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402'MHz									
2402	63.15	PK	H	25.65	3.90	0.00	92.70	N/A	N/A
2402	62.89	AV	H	25.65	3.90	0.00	92.44	N/A	N/A
2402	58.47	PK	V	25.65	3.90	0.00	88.02	N/A	N/A
2402	58.17	AV	V	25.65	3.90	0.00	87.72	N/A	N/A
2390	28.34	PK	H	25.61	3.84	0.00	57.79	74.00	16.21
2390	14.27	AV	H	25.61	3.84	0.00	43.72	54.00	10.28
4804	40.52	PK	H	30.59	4.67	27.26	48.52	74.00	25.48
4804	34.71	AV	H	30.59	4.67	27.26	42.71	54.00	11.29
7206	32.98	PK	H	34.09	6.50	26.30	47.27	74.00	26.73
7206	18.72	AV	H	34.09	6.50	26.30	33.01	54.00	20.99
9608	33.43	PK	H	35.96	8.75	26.22	51.92	74.00	22.08
9608	18.77	AV	H	35.96	8.75	26.22	37.26	54.00	16.74
1593.2	31.26	PK	H	23.79	3.16	26.90	31.31	74.00	42.69
1593.2	17.39	AV	H	23.79	3.16	26.90	17.44	54.00	36.56
482.6	32.53	QP	H	18.06	2.67	21.98	31.28	46.00	14.72
Middle Channel: 2440'MHz									
2440	63.38	PK	H	25.74	3.99	0.00	93.11	N/A	N/A
2440	63.29	AV	H	25.74	3.99	0.00	93.02	N/A	N/A
2440	58.56	PK	V	25.74	3.99	0.00	88.29	N/A	N/A
2440	58.36	AV	V	25.74	3.99	0.00	88.09	N/A	N/A
4880	40.73	PK	H	30.79	4.75	27.26	49.01	74.00	24.99
4880	35.15	AV	H	30.79	4.75	27.26	43.43	54.00	10.57
7320	33.73	PK	H	34.37	6.72	26.53	48.29	74.00	25.71
7320	18.59	AV	H	34.37	6.72	26.53	33.15	54.00	20.85
9760	34.41	PK	H	36.32	8.58	25.63	53.68	74.00	20.32
9760	18.73	AV	H	36.32	8.58	25.63	38.00	54.00	16.00
1593.2	31.62	PK	H	23.79	3.16	26.90	31.67	74.00	42.33
1593.2	17.35	AV	H	23.79	3.16	26.90	17.40	54.00	36.60
3618	32.71	PK	H	29.06	5.01	27.43	39.35	74.00	34.65
3618	20.15	AV	H	29.06	5.01	27.43	26.79	54.00	27.21
482.6	32.67	QP	H	18.06	2.67	21.98	31.42	46.00	14.58
High Channel: 2480'MHz									
2480	63.47	PK	H	25.85	3.82	0.00	93.14	N/A	N/A
2480	62.93	AV	H	25.85	3.82	0.00	92.60	N/A	N/A
2480	58.76	PK	V	25.85	3.82	0.00	88.43	N/A	N/A
2480	58.19	AV	V	25.85	3.82	0.00	87.86	N/A	N/A
2483.5	28.75	PK	H	25.86	3.80	0.00	58.41	74.00	15.59
2483.5	14.28	AV	H	25.86	3.80	0.00	43.94	54.00	10.06
4960	40.77	PK	H	31.00	4.70	27.27	49.20	74.00	24.80
4960	34.82	AV	H	31.00	4.70	27.27	43.25	54.00	10.75
7440	34.11	PK	H	34.66	6.95	26.56	49.16	74.00	24.84
7440	19.21	AV	H	34.66	6.95	26.56	34.26	54.00	19.74
9920	33.68	PK	H	36.71	8.41	25.50	53.30	74.00	20.70
9920	18.71	AV	H	36.71	8.41	25.50	38.33	54.00	15.67
1593.3	32.16	PK	H	23.79	3.16	26.90	32.21	74.00	41.79
1593.6	18.14	AV	H	23.79	3.16	26.90	18.19	54.00	35.81
482.6	32.35	QP	H	18.06	2.67	21.98	31.10	46.00	14.90

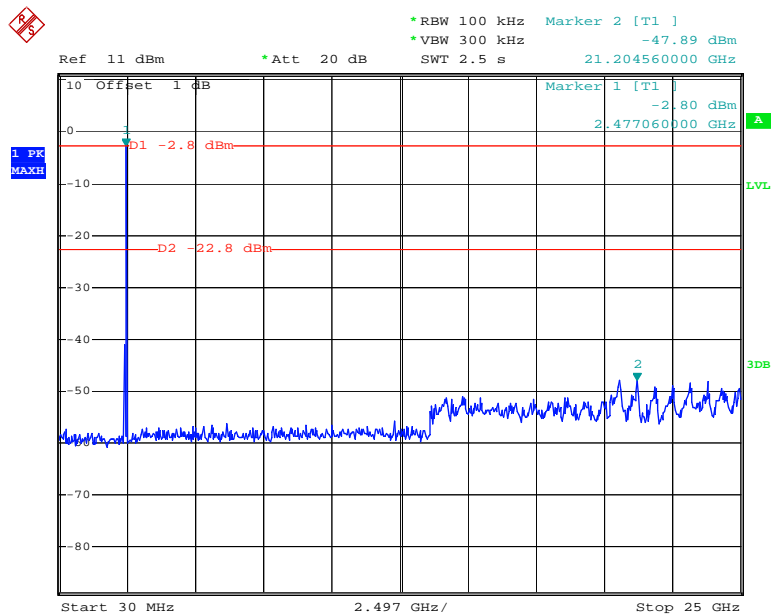
Conducted Spurious Emissions at Antenna Port**Low Channel**

Date: 15.NOV.2013 17:00:11

Middle Channel

Date: 15.NOV.2013 17:37:45

High Channel



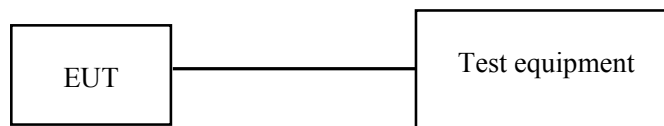
Date: 15.NOV.2013 17:38:51

FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH**Applicable Standard**

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	26 °C
Relative Humidity:	49 %
ATM Pressure:	101.5 kPa

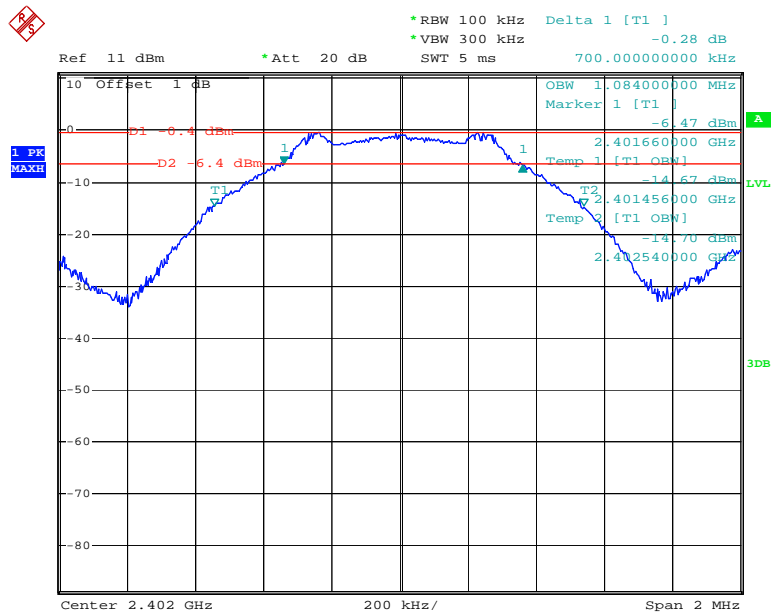
* The testing was performed by Ares Liu on 2013-11-15

Test Result: Pass.

Please refer to the following tables and plots.

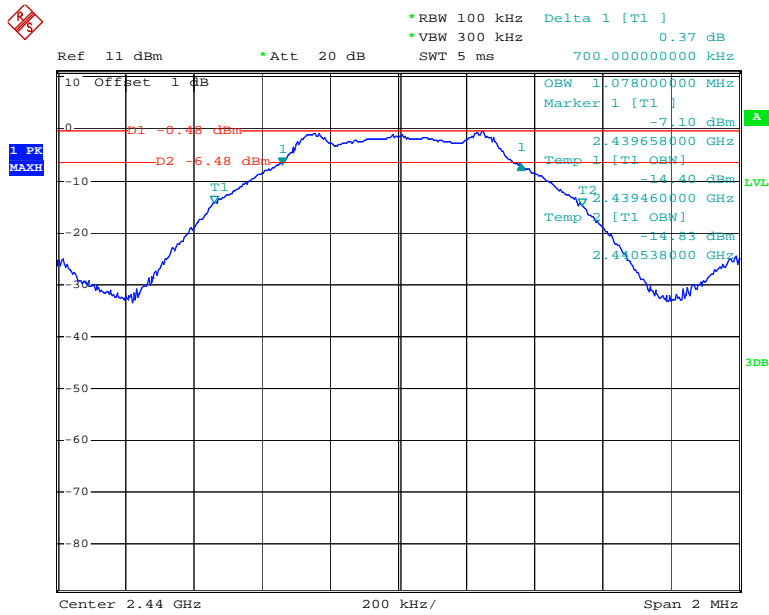
Channel	Frequency	6 dB Bandwidth	Limit
	(MHz)	(MHz)	(kHz)
Low	2402	0.700	> 500
Middle	2440	0.700	> 500
High	2480	0.698	> 500

Low Channel



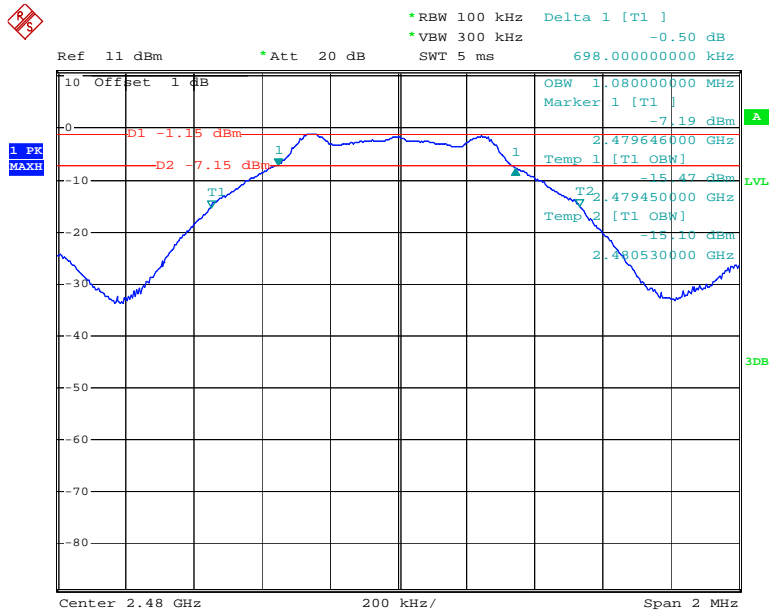
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Middle Channel



Date: 15.NOV.2013 17:17:49

High Channel



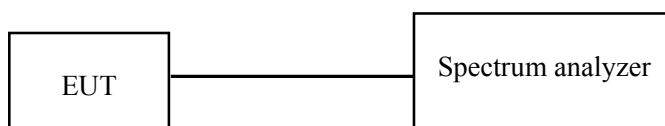
Date: 15.NOV.2013 17:33:58

FCC §15.247(b) (3) - MAXIMUM PEAK OUTPUT POWER**Applicable Standard**

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	26 °C
Relative Humidity:	49 %
ATM Pressure:	101.5 kPa

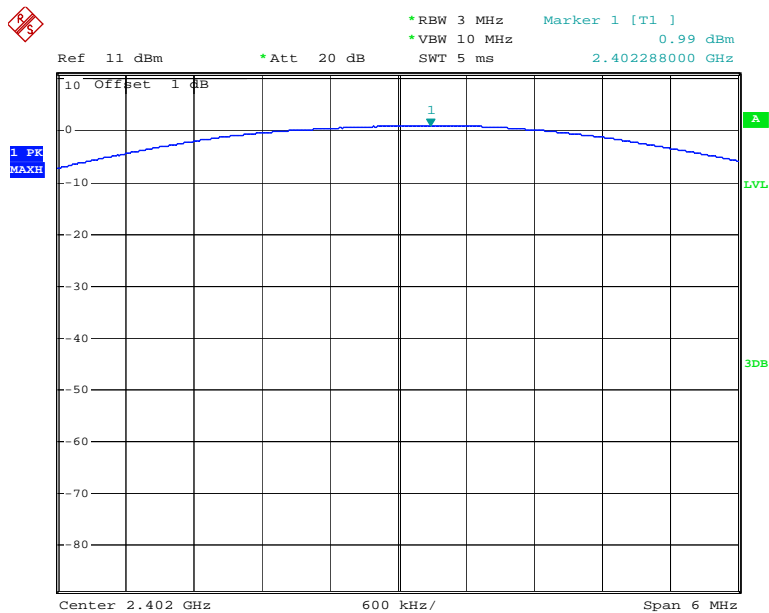
* The testing was performed by Ares Liu on 2013-11-15

Test Mode: Transmitting

Channel	Frequency	Conducted Output Power	Limit	Result
	(MHz)	(dBm)	(dBm)	
Low	2402	0.99	30	PASS
Middle	2440	0.20	30	PASS
High	2480	-0.38	30	PASS

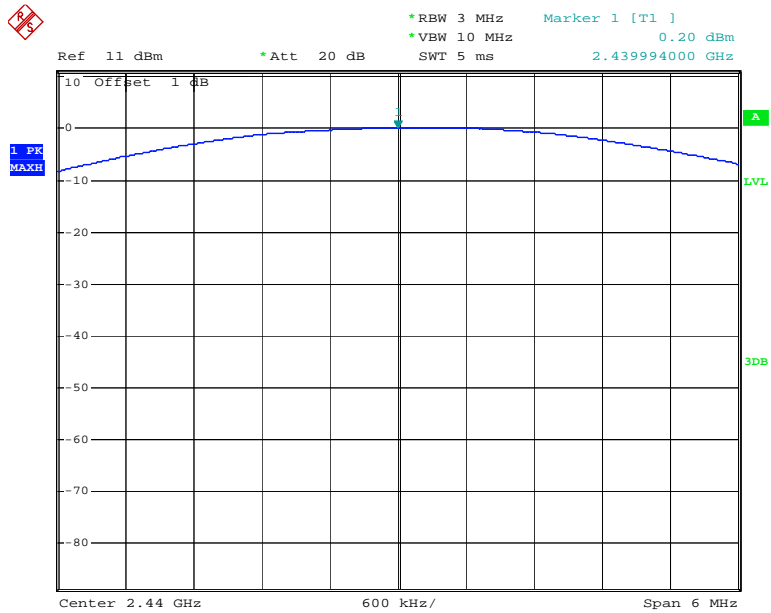
Please refer to the following plots

RF Output Power, Low Channel



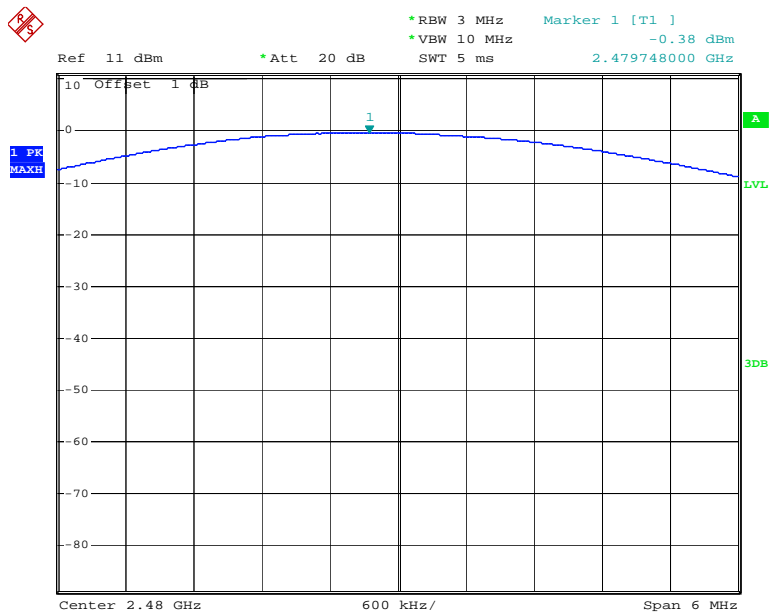
Date: 15.NOV.2013 17:20:14

RF Output Power, Middle Channel



Date: 15.NOV.2013 17:20:38

RF Output Power, High Channel



Date: 15.NOV.2013 17:21:00

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	26 °C
Relative Humidity:	49 %
ATM Pressure:	101.5 kPa

* The testing was performed by Ares Liu on 2013-11-15

Test Result: Compliance

Please refer to following plots.

1. PK
MAXH

Ref 11 dBm *Att 20 dB

*RBW 100 kHz Marker 1 [T1] -0.33 dBm
*VBW 300 kHz
SWT 10 ms 2.40236000 GHz

10 Offset 1 dB

Marker 2 [T1] -22.93 dBm
2.399212000 GHz

Marker 3 [T1] -50.32 dBm
2.399000000 GHz

Marker 4 [T1] -25.68 dBm
2.400000000 GHz

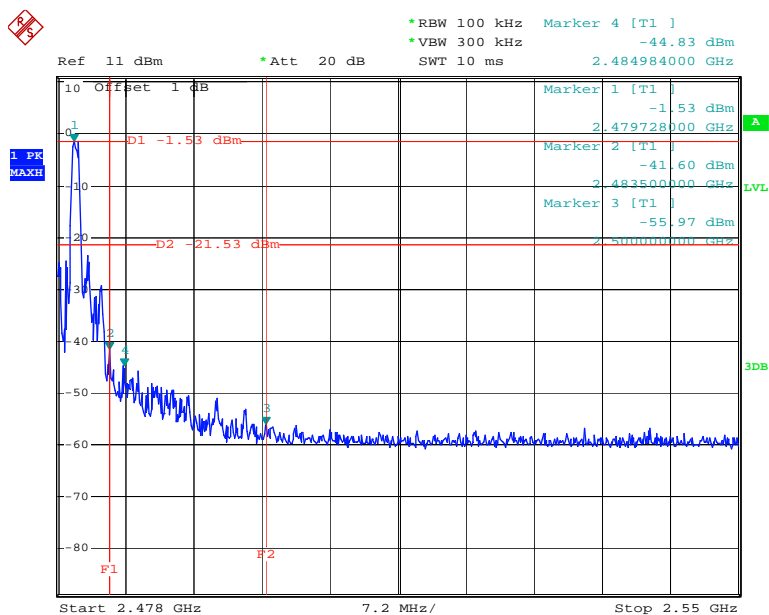
D1 -0.33 dBm

D2 -20.33 dBm

F1 F2

Start 2.32 GHz 8.4 MHz/ Stop 2.404 GHz

Band Edge, Right Side



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FCC §15.247(e) - POWER SPECTRAL DENSITY**Applicable Standard**

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the RBW = 3 kHz, VBW = 10 kHz, Set the span to 1.5 times the DTS bandwidth.
4. Use the peak marker function to determine the maximum amplitude level..

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	26 °C
Relative Humidity:	49 %
ATM Pressure:	101.5 kPa

* The testing was performed by Ares Liu on 2013-11-15

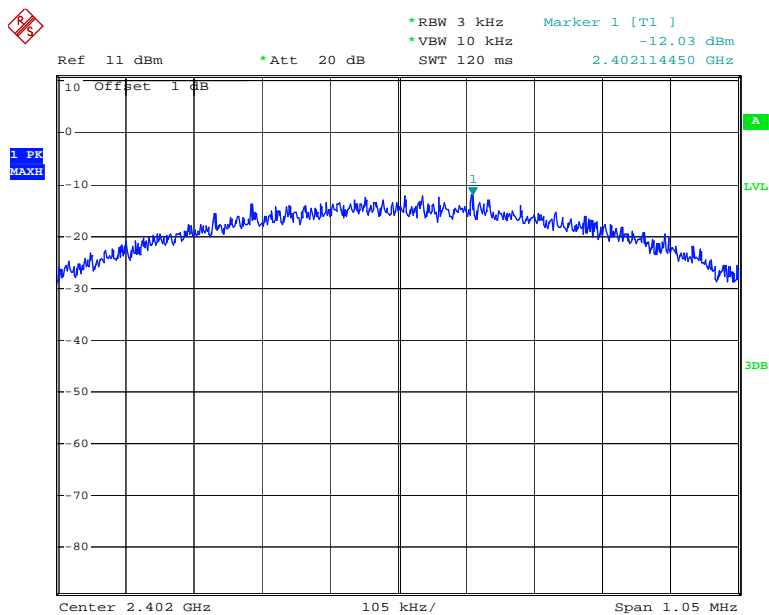
Test Mode: Transmitting

Test Result: Pass

Channel	Frequency	PSD	Limit	Result
	MHz	(dBm/3kHz)	(dBm/3kHz)	
Low	2402	-12.03	8	PASS
Middle	2440	-11.87	8	PASS
High	2480	-12.55	8	PASS

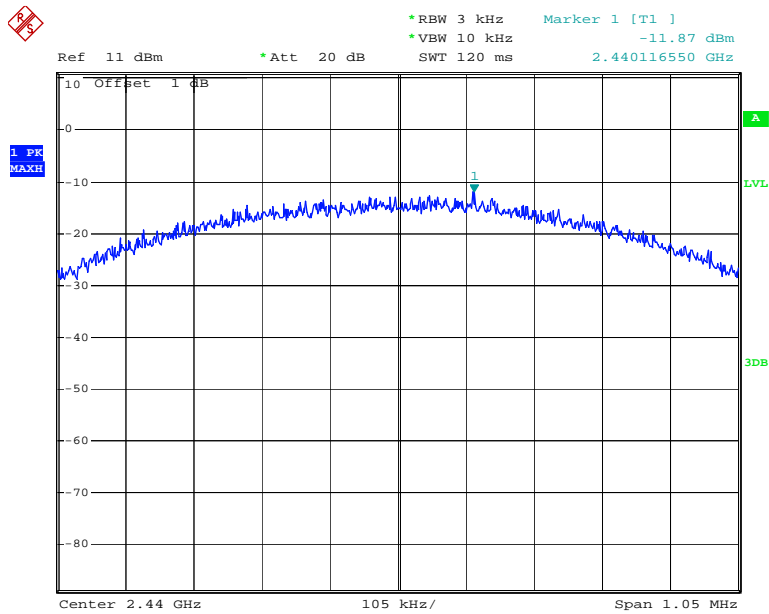
Please refer to the following plots

Power Spectral Density, Low Channel



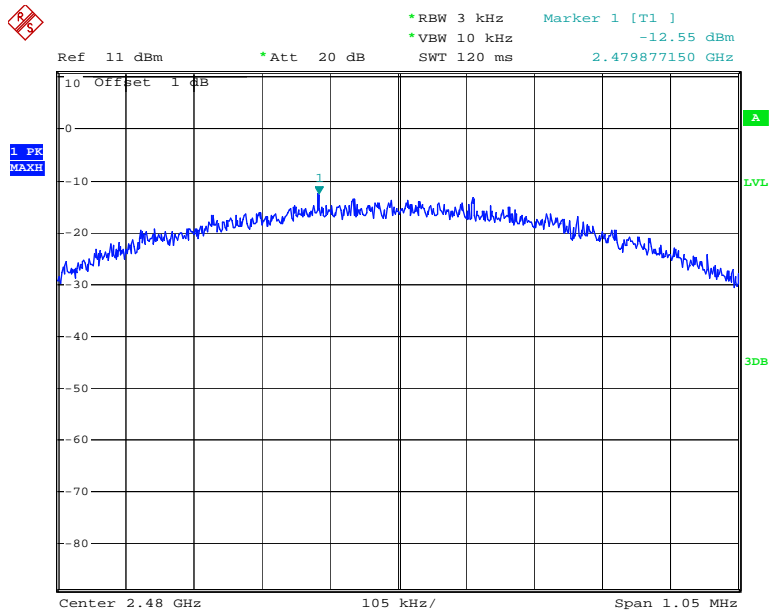
Date: 15.NOV.2013 17:06:21

Power Spectral Density, Middle Channel



Date: 15.NOV.2013 17:14:45

Power Spectral Density, High Channel



Date: 15.NOV.2013 17:34:49

***** END OF REPORT *****